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ORIGINAL ARTICLE

Pectoralis major tendon tears: functional outcomes and return to sport in a consecutive series of 40 athletes

Frank A. Cordasco, MD, MS*, Gregory T. Mahony, BA, Nicholas Tsouris, BA, Ryan M. Degen, MD

Sports Medicine and Shoulder Service, Hospital for Special Surgery, New York, NY, USA

Background: There are limited data on the outcomes of surgically repaired pectoralis major tendon (PMT) tears. The purpose of this study was to report the functional outcomes, return to sport, and second surgery rates in a consecutive series of PMT tears.

Methods: Forty patients with acutely repaired PMT tears were retrospectively identified. Follow-up was conducted with functional outcome scores and adduction strength testing at final follow-up. Return to sport and incidence of subsequent surgery were also recorded.

Results: The average age of the patients was 34.4 years (range, 23-59 years). Average follow-up was 2.5 years (range, 2-7.0 years). Twenty-three injuries (58%) occurred in the nondominant extremity. Bench press (n = 26) and contact sport participation (n = 14) were the most common mechanisms. Postoperative Single Assessment Numeric Evaluation scores averaged 93.6 (range, 62-100), with patient satisfaction of 9.6 of 10 (range, 6-10). All athletes returned to preinjury level of function approximately 5.5 months postoperatively (range, 4.5-6.5 months); 23.1% and 2.6% described mild or moderate difficulties with sport participation. Isokinetic strength evaluation revealed an average decrease of 9.9% (range, −18% to 41%). Application of the Bak criteria revealed 37% excellent, 26% good, and 37% fair outcomes, with most in the fair group reporting cosmetic concerns. Removing cosmesis, 46% scored excellent, 37% good, and only 17% fair. Three athletes required a second surgical procedure (7.5%).

Conclusions: Surgical repair of PMT tears resulted in high patient satisfaction, with excellent restoration of function and adduction strength, early return to sport, and few reoperations, albeit with the potential for mild cosmetic concerns.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Shoulder; pectoralis major; tendon repair; clinical outcome; tendon injuries; surgical repair

The pectoralis major muscle is a broad, triangular muscle with 2 divisions, arising predominantly from the medial clavicle and sternum, with attachments to the adjacent ribs and external oblique fascia.[12] The muscle fibers rotate approximately 90° from origin to insertion before coalescing into a single tendon inserting on the humerus, with those fibers originating from the clavicle inserting distally, whereas the fibers

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*Reprint requests: Frank A. Cordasco, MD, MS, Sports Medicine and Shoulder Service, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021, USA.

E-mail address: cordascof@hss.edu (F.A. Cordasco).

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from the sternum insert proximal and posterior.[12] The muscle functions as a strong adductor, internal rotator, and flexor of the humerus while also acting as a dynamic stabilizer for the glenohumeral joint.[12,13]

Historically, pectoralis major tendon (PMT) tears occurred infrequently. A systematic review identified only 365 cases in the literature since Patissier's description of the injury.[3,6,11] PMT tears have occurred with increasing frequency in recent years, likely to be attributable to increased participation in contact sports and weight-training activities.[3,6,12,15] There are several mechanisms of injury, including both direct and indirect trauma. Indirect traumatic ruptures are more prevalent, occurring secondary to resisted forced abduction, with involuntary contraction, or with a severe traction force.[12] Classically, these injuries occur during bench press, in the final phase of eccentric contraction as the patient transitions to a concentric contraction. At this point, the arm is in abduction and extension, with the inferior fibers maximally stretched and at a mechanical disadvantage, predisposing to injury.[16,17] Typically, this indirect mechanism produces avulsion injuries from the humerus rather than musculotendinous injuries.[14] Previous studies reported that improved outcomes can be anticipated with surgical repair compared with nonoperative treatment.[1,2,7,12,13] However, to date, there is little information available on anticipated functional outcomes and adduction strength after surgical repair. The purpose of this study was to report on the functional outcomes, isokinetic strength, return to sport, and incidence of subsequent surgery of the largest single-surgeon surgical cohort of PMT repairs to date.

Methods

We retrospectively reviewed prospectively collected data on all PMT tears between March 2008 and March 2016. Our inclusion criteria included young, active male patients with acutely treated (<8 weeks) PMT tears with a minimum of 2 years of follow-up. Exclusion criteria included chronic tears (n = 6), defined as those treated >8 weeks after the initial injury, and revision PMT repairs. We identified 40 patients who met inclusion criteria, and none of the available patients were lost to follow-up.

For included patients, we recorded patient demographics, hand dominance, side of injury, mechanism of injury, and time to return to sport. We confirmed the diagnosis of a PMT tear with a combination of physical examination and PMT-specific magnetic resonance imaging (MRI) to delineate the extent of injury, including muscle quality, the heads involved, the location of the tear using the Tietjen classification, and the degree of retraction.[16] Patients subsequently underwent surgical repair and repeated clinical evaluation at 2 weeks, 6 weeks, 3 months, and 6 months. Further follow-up occurred annually thereafter, including documentation of functional outcome scores, adduction strength testing, timing of return to sport, and incidence of subsequent surgery.

Surgical technique

The senior author (F.A.C.) treated all patients with a previously published surgical technique using unicortical buttons for tendon repair.[10] Briefly, we used the beach chair position with a combination of regional and general anesthesia and then performed a distal deltopectoral approach for exposure, with blunt dissection to identify the torn, retracted PMT. We débrided all nonviable tissue from the tendon edge and placed 2 sets of running, locking No. 2 FiberWire sutures (Arthrex, Naples, FL, USA) in a modified Krackow configuration, with 4 suture limbs for both the sternocostal and clavicular heads each. We then placed retractors to expose the humeral insertion and débrided the footprint while protecting the long head of the biceps. We placed 4 unicortical drill holes in a staggered fashion using a 3.2-mm guide pin (Arthrex) while angling the drill holes in a distal to proximal fashion to increase the available intramedullary length to flip the cortical buttons. We loaded the corresponding ends of each of the No. 2 FiberWire sutures through the cortical buttons and passed the buttons into the intramedullary canal. Sutures were tensioned with the arm adducted and in neutral rotation, with the sternocostal head reduced to the footprint first, followed by the clavicular head, both secured by tying standard knots with the sutures after tensioning. We confirmed button position with intraoperative fluoroscopy and subsequently performed a layered closure with application of a sling with the arm in an adducted position.

Postoperative rehabilitation

We instructed patients to remain in the sling for 4 to 6 weeks, followed by progressive range of motion exercises between 6 and 12 weeks. Physical therapists then initiated further strengthening and sport-specific rehabilitation after this initial period of immobilization, with an estimated return to activities at 5 to 6 months based on successful progression through the rehabilitation program.

Data collection

At a minimum of 6 months of follow-up, we measured functional outcomes either by telephone (n = 8) or with repeated clinical assessment (n = 32). Patients completed outcome measures including the Single Assessment Numeric Evaluation, patient satisfaction scores, and return to sport questionnaires. In addition, during the patient's most recent clinical assessment (average, 2.5 years; range, 2-7 years), isokinetic adduction strength was assessed with the Nicholas Manual Muscle Tester (Lafayette Instrument Company, Lafayette, IN, USA). Horizontal adduction was compared with the contralateral nonoperative extremity. We performed strength testing with the patient in a supine position and the examiner on the opposite side of the examination table. The arm was positioned in 90° of forward flexion and neutral rotation, with the elbow at 90° of flexion. The arm was then horizontally adducted to determine isokinetic adduction strength.

We then applied the Bak criteria[2] to determine a grading for each patient, using the patient's responses from these questionnaires and the obtained adduction strength information (Table I).

Data analysis

Following collection of the aforementioned variables, we calculated descriptive statistics, consisting of means and standard deviations for continuous variables and frequencies or percentages for all discrete variables.